REMARKS

Favorable reconsideration of this application is respectfully requested in light of the following remarks.

As an initial matter, the Examiner indicates in Paragraph 1 of the Official Action that new formal drawings are required because the submitted drawings do not give a clear depiction of the claimed apparatus. However, Applicant respectfully disagrees with this contention. In particular, Applicant asserts that the drawings do in fact adequately show the features of the apparatus. However, should the Examiner maintain this objection, Applicant respectfully requests that the Examiner more clearly describe how the drawings do not adequately show the features of the present invention.

With respect to the drawing objections indicated in Paragraph 2 of the Official Action, Applicant has amended the specification and changed Figure 3 to more clearly indicate the induction surface for the external field, which is now designated by the reference number 20. The specification has also been amended for consistency. Accordingly, withdrawal of the drawing objections is respectfully requested.

Claim 2 stands rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particulary point out and distinctly claim the subject matter which Applicant regards as the invention. In particular, the Examiner objects to the use of the phrase "approximately equal" in Claim 2 as allegedly being a relative term, therefore rendering the claim indefinite. However, the term "approximately" is comparable to the term "about". The Board of Patent Appeals and Interferences has held that the use of the term "about" is clear and not indefinite. *Ex parte Eastwood* 163 USPQ 316 (Bd. App.

1969). As such, Applicant submits that the term "approximately equal" does not render the claim indefinite. Accordingly, withdrawal of the rejections based on 35 U.S.C. § 112, second paragraph, is respectfully requested.

Claim 1 stands rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 3,118,015 to *Willyoung*. In addition, Claim 2 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over *Willyoung*.

The disclosed embodiment of the present invention pertains to a stator winding bar for an electrical machine. A plurality of strands are arranged in stacks on top and next to each other. An active part extends along a winding slot of the stator laminated core. The active part is adjoined on each of both sides by an end winding. The active part is divided in length into a central middle part and two border zones of equal length enclosing the central middle part. The strands of the stator winding bar are transposed in the active part according to the manner of a Roebel bar with each other by approximately 450°, of which 270° are on the middle part and 90° each are on the two border zones, while the strands in the end windings extend without transposition parallel to each other. For the compensation of the external fields that act in the region of the end winding and induce circulating currents, the middle part of the active part has a length that is greater than 3/4 of the total length of the active part. None of the prior art of record disclose these patentable features.

In particular, the Examiner seeks to rely on the disclosure of *Willyoung* for disclosing the features of independent Claim 1. However, *Willyoung* does not disclose the patentable features of independent Claim 1. *Willyoung* was specifically addressed in the Background of the Invention of the present application. In particular, *Willyoung* shows in

figure 3 (not in figure 5) the so called 450° transposition. It consists of two outer parts of the same length of 1/8 of the active part and a center part of a length of 3/4 of the active part. This is one of the possible solutions given by *Willyoung* according to his formulation which says that the total length of the active part is divided into 3 parts. These are 2 end parts of the same length equal to $\frac{l*k}{2}$ and a transposition angle of k * 360° and a center part of a length of (1-k)*l and a transposition angle of (1-k)*360°. This means that the center part has a specific transposition angle of $\frac{(1-k)*360°}{(1-k)*l}=\frac{360°}{l}$, which is exactly the same value as given in the original simple 360° transposition of L. Roebel of 1912. The outer parts have a specific transposition angle of $\frac{k*360°}{k*1/2}=\frac{720°}{l}$, which is exactly twice as much as in the center part.

To conclude, any solution given by *Willyoung* consists always of the same two different specific transpositions, i.e. $\frac{360°}{l}$ and $\frac{720°}{l}$. No other specific transposition is included in *Willyoung*. This means also that the active part is totally compensated electromagnetically within its length but the end winding field is never compensated totally. Either there remains an uncompensated part of the proximity effect (e.g. 450° transposition), an uncompensated part of the skin effect, or both effects are only partly compensated (transposition angles of $>360°$ and $<720°$, not 450° and not 540°).

The present invention deals with a solution in which the specific transpositions do not obey the rules of *Willyoung* for the 450° transposition. In particular, the outer parts show a specific transposition of more than $\frac{720°}{l}$ (parts shorter) and the center part shows one of less than $\frac{360°}{l}$ (part longer). The advantage is that one gets the opportunity to

compensate fully the proximity effect of the magnetic field in the end winding zones. Accordingly, *Willyoung* fails to disclose the features of independent Claim 1.

For at least the foregoing reasons, it is submitted that the stator winding bar of the present invention, as defined in independent Claim 1, and the claims depending therefrom is patentably distinguishable over the applied document. Accordingly, withdrawal of the rejections of record and allowance of this application are earnestly solicited.

Should any questions arise in connection with this application, or should the Examiner believe a telephone conference would be helpful in resolving any remaining issues pertaining to this application, the undersigned respectfully requests that she be contacted at the number indicated below.

Respectfully submitted,

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Page 1, Paragraph 0002,

Alternating current machines use Roebel bars for the armature winding. Roebel bars consist of insulated [shrouds] strands that are arranged on top and next to each other and transposed. The transposition patented by L. Roebel in 1912 provides a full turn in the active part (360° transposition). In the end zones (end winding), the bar is not transposed. This type of transposition compensates the field along the active part. However, it does not compensate the field components of the end winding.

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Page 3, Paragraph 0010:

Preferred embodiments of the invention are disclosed in the following description and illustrated in the accompanying drawings, in which:

Fig. 1 shows a standard schematic illustration of the actually known 450° transposition according to *Willyoung* of a stator winding bar with 2 x 6 [shrouds] strands and the surfaces of two selected [shrouds] strands, which are effective for the external field, with the plus or minus signs that are important for the summation of the loop currents (the surfaces or respectively external field portions in the end windings are not compensated);

Fig. 2 shows the situation of the stator bar in Fig. 1 in relation to the inherent field;

Fig. 3 shows an illustration of an exemplary embodiment of a stator bar according to the invention, with extended middle part and resulting compensation of the external field portions in the end windings;

Fig. 4 shows the situation of the stator bar in Fig. 3 in relation to the inherent field; and,

Fig. 5 shows a comparison of the amplitudes of the [partial conductor] strand currents in relation to the nominal value for the example of a stator winding bar with standard 450° transposition (graph a) and transposition according to the invention (graph b).

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Page 3, Paragraph 0011:

Fig. 1 to 4 each show a side view of a stator winding bar 10 (Roebel bar) with a total of 2 x 6 = 12 [shrouds] strands 11,..,14. The stator winding bar 10 is positioned with an active part AT in the winding slot of the stator laminated core. Within the active part, the [shrouds] strands 11,..,14 undergo a transposition of 450°. End winding WK, in which the [shrouds] strands 11,...,14 are not transposed, border the active part AT on both sides. The active part AT is divided into a middle part MT and two border zones RZ of equal length that enclose the center part MT. In the center part, the transposition is 270°, in the border zones RZ 90° each.

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Page 4, Paragraph 0013:

Reference number 11 stands for the 6 [shrouds] strands of the rear stack (in viewing direction); reference number 12 stand for the front stack. When the [shrouds] strands are located in the front during the transposition, they are drawn with continuous lines; when they are in the back, they are drawn with broken lines. A representative loop with [shrouds] strands 13 and 14 is in each case drawn with a thick line and is used to evaluate the transposition, whereby the plus or minus signs essential for the compensation are in each case entered. Two evaluations are made: first the external field analysis in Fig. 1 or Fig. 3 (surfaces within the loops must be added with the respective, correct plus or minus signs), and then the inherent field analysis in Fig. 2 or Fig. 4 (surfaces within the loops in relation to the center line 15 of the winding bar must be added with the respective, correct plus or minus signs). If the sum of all partial surfaces is zero, no circulating currents occur.

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Page 4, Paragraph 0014:

As can be clearly seen from Fig. 1, the external field portions in the end windings WK, which penetrate the loop (drawn with thick line) of [shrouds] strands 13 and 14, are not compensated during the standard transposition. In contrast, the external field portions in the active part AT are all compensated.

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Page 4, Paragraph 0016:

According to the invention, the formula of *Willyoung* regarding the length of the middle part MT for the 450° transposition is now changed to the effect that this section is extended beyond 3/4 of the length of the active part AT (the middle part MT still has a 270° transposition). In this way, the [shrouds] strands that carry most of the current, are kept near the [slot base] slot bottom for a longer distance, and those that carry the least current are kept for a longer distance in the active part AT towards the slot opening. It is known that these conditions have a compensating effect on the current distribution in the Roebel bar. This transposition can be described as (0/450unv/0) (unv = incompletely compensated in active part, in order to compensate the residual field of the end winding).

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Page 5, Paragraph 0017:

According to Fig. 3, in such a stator winding bar with 450° transposition in the extended active part AT, the external field portions in the end windings WK that penetrate the loop (shown bold) of the [shrouds] strands 13 and 14, are compensated by the cross-wise striated (additional) portions 20 in the active part AT. The extension of the middle part MT is hereby preferably chosen so that a maximum compensation is achieved. The residual external field portions in the active part AT are all compensated.

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Page 5, Paragraph 0019:

If such a (0/450unv/0) transposition is performed for a two-pole turbo generator with a two-layer winding (consisting of bars with, for example, two stacks of [shrouds] strands; a total of 100 [shrouds] strands), significant improvements are achieved in comparison to the standard transposition according to *Willyoung*. Fig. 5 shows the amplitudes of the [shroud] strand currents (related to the nominal value), at nominal load, on top of the number of the respective [shroud] strand Graph (a) hereby relates to the standard (0/450/0) transposition, graph (b) to the novel (0/450unv/0) transposition. It can be clearly seen that this invention is able to almost completely eliminate the circulating currents (max. [shroud] strand currents are max. 20% above reference value). This provides a construction of a Roebel bar without end winding transposition that makes it possible to effectively suppress the circulating currents.

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Mark-up to Claim 1

1. (Twice Amended) A stator winding bar for an electrical machine, comprising:

a plurality of [shrouds] strands arranged in stacks on top and next to each other;

an active part extending along a winding slot of the stator laminated core, said active part being adjoined on each of both sides by an end winding, whereby said active part is divided in length into a central middle part and two border zones of equal length enclosing the central middle part, and whereby the [shrouds] strands of the stator winding bar are transposed in the active part according to the manner of a Roebel bar with each other by approximately 450°, of which 270° are on the middle part and 90° each are on the two border zones, while the [shrouds] strands in the end windings extend without transposition parallel to each other, characterized in that, for the compensation of the external fields that act in the region of the end winding and induce circulating currents, the middle part of the active part has a length that is greater than 3/4 of the total length of the active part.